

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Biomedical Engineering
(Applicable from the academic session 2018-2019)

SEMESTER-VII

Name of the Course	PRINCIPLES OF MANAGEMENT & ORGANIZATION BEHAVIOUR
Course Code: HM-HU701	Semester: Seventh
L-T-P-C: 4-0-0-4	Contact: 4 hrs/week
Objectives:	
1	To enable the students to study the evolution, functions and principles of management.
2	To know about organizational structure, organizational behaviour and personality development.
3	To learn about motivational techniques and skill required to work in a group and the process of group decision making.
4	To know various leadership styles and the role of leader in achievement of organizational objectives.
5	To learn about the reasons for organizational change and its development.
Pre-Requisite: Technical English (HMHU301), Basic knowledge of Management	

M#	Content	Hrs
1	Introduction to Management & Organization: Definition of management, evolution of management, human relations, system and contingency approaches, types of managers, role of managers, manager vs. entrepreneur, organizational structure, centralization and decentralization, selection and recruitment, training and development, current trends and issues in management.	8
2	Planning & Directing: Nature and purpose of planning, planning process, types of plans, objectives, managing by objective strategies, types of strategies, policies, decision making, types of decision, decision making process, rational decision making, market planning, Marketing Mix, advertising and brand management, creativity and innovation, motivation and satisfaction, motivation theories, leadership styles, leadership theories, CSR.	12
3	Controlling & Quality Management: Process of controlling, types of control, managing productivity, cost control, financial statements and ratio analysis, maintenance control, quality control with control charts, TQM, Kaizen and six sigma, MIS.	14
4	Organizational Behaviour: Definition, importance, fundamental concepts of OB, challenges and opportunities for OB, meaning of personality, development of personality, determinants of personality, application of personality in the organizational level, communication, concept of group dynamic, types of group, group behaviour, group decisions and techniques to improve group decision, merits and demerits of group decisions.	10
5	Organizational Change: Meaning and nature of organizational change, factors of organizational change, resistance to change, factors in resistance, overcoming resistance to change, organizational development-concept, objectives and process of organization development.	8

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Biomedical Engineering
(Applicable from the academic session 2018-2019)

COURSE OUTCOMES

At the end of the course, students should be able to:

1. Recognize the fundamental concepts of management that are vital for the development of a conceptual framework of management as a discipline.
2. Demonstrate knowledge of organizational structure, organizational conflict, negotiation, politics and change.
3. Apply the principles of decision making through planning, organizing, directing and controlling.
4. Implement effective communication skills to handle group behavior and monitor human resources through effective leadership.
5. Relate knowledge of ethics in the context of corporate social responsibility and advertising, brand management and product positioning across cultural diversities.
6. Create a congenial and cohesive ambience within the framework of organizational structure in achieving the organizational goals.

Text/Reference Books:

1. Bhat, A. Kumar, "Management: Principles, Processes & Practices" OUP.
2. Charles W.L.Hill, Steven L. McShane, "Principles of Management" McGraw Hill Education, Special Indian edition, 2007
3. Previr Kapoor, "Principles of Management" Khanna Publishing House, New Delhi.
4. Koontz, "Essentials of Management" Revised Edition, Tata McGraw Hill.
5. Arun Kumar, N. Meenakshi, "Organisational Behaviour" Vikas Publishing House, 2009.
6. S. P. Robbins, T.A. Judge, "Organizational Behavior", Pearson Education, 15th Edn.
7. Luthans, Fred, "Organizational Behavior", McGraw Hill, 12th Edn.
8. Shukla, Madhukar, "Understanding Organizations-Organizational Theory & Practice in India", PHI
9. R. Fincham, P. Rhodes, "Principles of Organizational Behaviour", OUP, 4th Edn.
10. Hersey, P., Blanchard, K.H., Johnson, D.E.- Management of Organizational Behavior Leading Human Resources, PHI, 10th Edn.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Biomedical Engineering
(Applicable from the academic session 2018-2019)

Name of the Course	MEDICAL IMAGE PROCESSING
Course Code: PC-BME701	Semester: Seventh
L-T-P-C: 3-0-0-3	Contact: 3 hrs/week
Objectives:	
1	To introduce students about the fundamental concepts of medical image processing.
2	To discuss the transform with respect to basic functions, properties and applications.
3	To understand the basic medical image enhancement, segmentation, compression, representation techniques and algorithms.
4	To provide students with an overview of the computational and mathematical methods in medical image processing.
Pre-Requisite: Biomedical Digital Signal Processing (PCBME601), Medical Imaging Techniques.	

M#	Content	Hrs
1	Digital Image Fundamentals & Transforms: Basic idea of medical images, digital image representation, steps in digital image processing, sampling and quantization, relationships between pixels, colour image fundamentals-RGB, image transforms: discrete transform, fast Fourier transform, 2-D Fourier transform and inverse Fourier transform.	8
2	Image Enhancement: Spatial domain method, frequency domain method, contrast enhancement, histogram processing, image smoothing, image averaging, masking, image sharpening, removing of blur caused by uniform linear motion, enhancement in the frequency domain: low pass, high pass, mean and band-pass filtering, high boost filtering, homomorphic filtering, special examples using US and CT images.	9
3	Image Segmentation: point detection, line detection, edge detection, thresholding, region growing, region splitting and merging, morphological processing, erosion and dilation, segmentation by morphological watersheds.	8
4	Image Compression: Need of medical image compression, fidelity criteria, image compression models, lossy and lossless compression techniques, image compression standards.	6
5	Image Restoration & Reconstruction of Medical Images: Degradation models, algebraic approach to restoration, inverse filtering, Wiener filtering, image reconstruction from back projections, Radon transforms, filter back projection reconstruction of CT images, Fourier reconstruction of MRI images.	9

COURSE OUTCOMES

At the end of the course, students should be able to:

1. Demonstrate the concepts and techniques in digital image processing.
2. Analyze the performance of various medical image processing techniques.
3. Perform image compression using lossy and lossless techniques.
4. Implement image enhancement techniques in spatial and frequency domain.
5. Perform image segmentation and image restoration.
6. Design and implement algorithm(s) for medical image processing applications.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Biomedical Engineering

(Applicable from the academic session 2018-2019)

Text/Reference Books:

1. R.C. Gonzalez, R.E. Woods, "Digital Image Processing", Pearson Education 3rd edition, 2010.
2. Anil K Jain, "Fundamentals of Digital Image Processing", Pearson, 2002.
3. Chanda&Majumdar, "Digital image processing and analysis", PHI
4. Sinha& Patel, "MedicalImage Processing-Conceptand Application"
5. G Dougherty, "DigitalImage ProcessingforMedicalApplications"
6. R.C. Gonzalez, R.E. Woods, SEddins, "Digital Image Processing using MATLAB", Pearson Education Inc 2011
7. Kenneth R Castleman, "Digital Image Processing", Pearson, 2006.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Biomedical Engineering
(Applicable from the academic session 2018-2019)

Name of the Course	HOSPITAL ENGINEERING & MANAGEMENT
Course Code: PE-BME701	Semester: Seventh
L-T-P-C: 3-0-0-3	Contact: 3 hrs/week
Objectives:	
1	To understand the fundamentals of hospital engineering, management system and organization.
2	To study about various medical services and quality and safety aspects in hospital.
3	To impart knowledge regarding clinical engineering, biomedical engineering, safety technology and hospital information system.
Pre-Requisite: Biomedical Instrumentation (PCBME402), Basic knowledge of Management.	

M#	Content	Hrs
1	Healthcare System: Roles of hospital in healthcare, health organization of the country, Indian hospitals - challenges and strategies, introduction to hospital engineering system, management concept and organization, modern techniques of hospital management.	4
2	Hospital Organization & Medical Services: Classification of hospitals, role of hospital in healthcare, location and environment of hospital, wards and departments, outpatient services, inpatient services, emergency services, clinical laboratories, radiology services, OT services, pharmacy, line services, supportive services and auxiliary services, role of biomedical engineers in hospital.	12
3	Engineering Services & Safety: Engineering departments, maintenance department, preventive maintenance of equipment, power supply system, air conditioning system, water supply and sanitary system, centralized gas supply system, central sterilization system, communication system, electrical safety, fire safety and alarm system, waste disposal system.	12
4	Hospital Management & Information System: Hospital management system, MRO, role of HMIS, functional areas, modules forming HMIS, HMIS and internet, RIS, centralized data records system, computerized patient record system, health information system, disaster management.	8
5	Regulation & Safety Protocols: FDA regulation, ISO certification, NABH, NABL, clinical laboratory standards to infection control, healthcare worker safety, fire protection standard.	4

COURSE OUTCOMES

At the end of the course, students should be able to:

1. Classify hospitals, different units and their functions in hospital.
2. Demonstrate knowledge of strategic planning and decision making in the healthcare.
3. Assess and prioritize various medical and engineering services in hospital.
4. Implement information system for effective and improved healthcare delivery.
5. Apply skills for improving safety and the quality of care in hospital.
6. Practice professional ethics and legal issues in hospital engineering and healthcare system management.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Biomedical Engineering

(Applicable from the academic session 2018-2019)

Text/Reference Books:

1. R.C. Goyal, "Handbook of Hospital Personal Management", Prentice Hall of India, 1993.
2. Hans Pfeiff, Vera Dammann (Ed.), "Hospital Engineering in Developing Countries", Zreport Eschbom, 1986.
3. Antony Kelly, "Maintenance planning and control", Butterworths, London.
4. Cesar A. Caceres and Albert Zara, "The practice of clinical engineering", Academic Press, 1977.
5. Webster, J. Gand Albert M. Cook, "Clinical Engineering Principles and Practices", Prentice Hall Inc. Englewood Cliffs, 1979.
6. Jacob Kline, "Handbook of Bio Medical Engineering", Academic Press, San Diego 1988.
7. Sanjiv Singh, Sakthi Kumar Gupta, Sunil Kant, "Hospital infection control guidelines, principles and practice", Jaypee Brothers Medical Publishers Pvt Limited, First edition, 2012.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Biomedical Engineering
(Applicable from the academic session 2018-2019)

Name of the Course	HOSPITAL SAFETY & MANAGEMENT
Course Code: PE-BME702	Semester: Seventh
L-T-P-C: 3-0-0-3	Contact: 3 hrs/week
Objectives:	
1	To impart adequate information on hazards, safety and precautionary measures in health care system.
2	To provide basic knowledge on the concept of healthcare quality management towards continuous improvement of patient care.
3	To make the students aware of the role of biomedical engineer in hospitals, especially in the management of electrical supply, maintenance of electrical safety, etc.
4	To understand the policies, safety standards in compliance with regulatory requirements and within engineering limits.
Pre-Requisite: Biomedical Instrumentation (PCBME402), Basic knowledge of Management.	

M #	Content	Hrs
1	Hospital Safety: Security and safety of hospital-property, staff and patients, radiations safety, safety precautions, hazardous effects of radiation, allowed levels of radiation, ICRP regulations for radiation safety, disposal of biological waste.	6
2	Electrical & Fire Safety: Electrical hazards, causes of electrical shock, effect of shocks, macro and micro shocks-hazards, monitoring and interrupting the operation from leakage current, safety precautions for electrical hazards, elements of fire, causes of fire, action to be taken in case of fire in a hospital.	8
3	LASER & Ultraviolet Radiation Safety: Classification of UV radiation, sources of UV, biological effects of UV, hazards associated with UV radiation, UV control measures, safety management of UV, classification of LASER and its radiation hazards, control measures, emergencies and incident procedures.	8
4	Assessing Quality & Regulatory Requirement for Healthcare: Patients safety, organization-Governmental and independent, measuring quality care, evaluation of hospital services, six sigma way, quality assurance in hospitals, patient orientation for total patient satisfaction, 5S techniques, FDA regulations, accreditation for hospitals-JCI, NABH and NABL, other regulatory codes.	10
5	Standardization of Quality Medical Care in Hospitals: Define quality, need for standardization and quality management, TQM in healthcare organization, quality assurance methods, QA in (Medical Imaging & Nuclear medicine) diagnostic services, classification of equipment, medical device safety and risk management, effectiveness/performance of medical devices, role of each participant/stakeholder, shared responsibility for medical device safety and performance.	8

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Biomedical Engineering
(Applicable from the academic session 2018-2019)

COURSE OUTCOMES

At the end of the course, students should be able to:

1. Demonstrate the types of hazards, planning, organization and training needed to work safely with hazardous materials.
2. Recognize and evaluate safety and health hazards and select appropriate control methodologies based on the hierarchy of controls.
3. Utilize regulatory standards as a guide to apply policies, procedures, standards and occupational safety and health principles.
4. Design, implement and monitor quality and safety initiatives in the health services.
5. Practice due diligence and employ managerial responsibility in creating and maintaining a culture of regulatory compliance in healthcare, including the management of accreditation processes.
6. Evaluate and apply quality, safety and management competencies to improve and assure healthcare standards.

Text/Reference Books:

1. Khandpur R.S, "Hand book of Biomedical instrumentation", TMH
2. Carr & Brown, "Introduction to Biomedical Equipment", PHI
3. Webster J.G and Albert M. Cook, "Clinical Engg, Principles & Practices", Prentice Hall Inc., Engle wood Cliffs, New Jersey, 1979.
4. Cesar A. Cacere & Albert Zana, "The Practice of Clinical Engg.", Academic press, New York, 1977.
5. B.M. Sakharkar, "Principles of Hospital administration and Planning", JAYPEE Brothers, Medical Publishers (P) Ltd.
6. K. Shridhara Bhat, "Quality Management", Himalaya Publishing House.
7. Karen Parsley, Karen Parsley Philomena Corrigan, "Quality improvement in Healthcare", 2nd edition, Nelson Thornes Pub, 2002
8. Sharon Myers, "Patient Safety & Hospital Accreditation- A Model for Ensuring Success" Springer Publishers 2012
9. Joseph F Dyro, "Clinical Engineering Handbook" Elsevier Publishers, 2004

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Biomedical Engineering
(Applicable from the academic session 2018-2019)

Name of the Course	SPORTS MANAGEMENT
Course Code: PE-BME703	Semester: Seventh
L-T-P-C: 3-0-0-3	Contact: 3 hrs/week
Objectives:	
1	To provide knowledge of the medical field related to physical activity and sports.
2	To learn basic medical skills and science of injury prevention, treatment and rehabilitation as it relates to sports management.
3	To gain the basic knowledge to evaluate, diagnose and manage common disorders seen in sports medicine.
Pre-Requisite: Engineering Physiology & Anatomy (PCBME302), Biophysics & Biochemistry (PCBME303), Biomechanics & Rehabilitation Engineering.	

M#	Content	Hrs
1	Introduction to Sports Medicine: Meaning and concept of sports medicine, scope of sports medicine, history of sports medicine in India, prevention of sports injuries, role of physical educators and coaches in the prevention of sports injuries, pre-conditioning injury prevention exercises and drives static stretching exercises, therapeutic exercise and their classification.	9
2	Sports Injuries: Terminology and classification of common sports soft tissue injuries, pathological changes in sprains, strain and contusion and their management, regional injuries and their management-injuries of head, ears, eyes, nose, back, shoulders, elbows, hand, abdomen, thighs, knee, leg and ankle.	8
3	Rehabilitation Procedures: Principles of rehabilitation of injuries, therapeutic modalities-cryotherapy, hydrotherapy, electrotherapy and lesser therapy, massage and its techniques.	5
4	Physiology of Exercise: Short and long term effects of exercise on muscular tissues, physiological principles of development of strength, endurance, speed and flexibility, heart role and exercise, threshold for training effects on heart, cardiac reserve capacity, blood pressure and exercise, lungs ventilation during rest and exercise, change in lungs diffusions during muscular activities.	9
5	Socio Psychological Factors: Stress and sports competitions, socio psychological stress and human performance in sports, Seley's theory of stress and its implications, psychology and physiology of stress, measurement of stress, over training stress syndrome, psycho-physiological training for stress and psycho-somatic fitness, yoga therapy for psycho-physiological ailments, yoga and psycho-physiological training of games and sports.	9

COURSE OUTCOMES

At the end of the course, students should able to:

1. Apply concepts, skills and techniques necessary for improving sports activities.
2. Demonstrate mechanical, biological and physiological implications involved in sports.
3. Correlate physical conditioning for the prevention of injuries and counsel mental health.
4. Diagnose and evaluate injuries using suitable methods and techniques.
5. Propose appropriate therapeutic modalities for rehabilitation of injuries.
6. Integrate other professionals within the allied health profession and medical field.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Biomedical Engineering

(Applicable from the academic session 2018-2019)

Text/Reference Books:

1. Armstrong, Tuckler, "Injuries in Sports", London, Staples Press, 1964.
2. J.P.Bolan,P.J.Rasch,"Treatment and Prevention of Athletic Injuries", Inter-state Printers and Publishers, 1967.
3. L.E.Morehouse, P.J.Rasch,"Sports Medicine for Trainers", Philadephia, W.B. Saunder CO.1963.
4. Ryans Allan, "Medical Care of the Athlete", McGraw Hill.
5. Morchouse, Miller : Physiology of Exercise
6. Falls : Exercise Physiology
7. Karpovitch : Physiology of Muscular activity
8. Pande, P.K. "Know How Sports Medicine?" AP Publications, Jalandhar

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Biomedical Engineering
(Applicable from the academic session 2018-2019)

Name of the Course		BIOLOGICAL CONTROL SYSTEMS & MODELLING
Course Code: OE-BME701		Semester: Seventh
L-T-P-C: 3-0-0-3		Contact: 3 hrs/week
Objectives:		
1	To impart knowledge about various regulatory processes in designing a bio-control system.	
2	To understand the basic ideas related to modelling and different modeling techniques for analysis and synthesis of dynamic physiological systems.	
3	To understand methods and techniques to analyze and synthesize dynamic models.	
4	To equip the students with necessary knowledge on analysis and design parameters of biological control system.	
Pre-Requisite: Engineering Physiology & Anatomy (PCBME302), Biophysics & Biochemistry (PCBME303), Signals & Systems in Biomedical Engineering (PCBME301), Physics, Higher Engineering Mathematics.		

M#	Content	Hrs
1	Introduction: Technological control system, mathematical approaches, system stability, biocontrol system, differences and similarities between biological and engineering control system, mathematical modeling of physiological system, technique of mathematical modeling, classification of models-black box and building block, characteristics of models, linearization of nonlinear models, Time invariant and time varying systems for physiological modeling.	12
2	Bioprocess Regulation: Acid-base balance, extra-cellular water and electrolyte, interstitial fluid volume, blood pressure, blood glucose, CO ₂ , thermal regulatory system.	6
3	Biological Control Mechanism: Cardiac rate, respiratory rate, mass balancing of lungs, oxygen uptake by RBC and pulmonary capillaries, oxygen and carbon dioxide transport in blood and tissues, urine formation and control, Pupil control systems, skeletal muscle servomechanism and semicircular canal, endocrine control system.	8
4	Physiological Modeling: Purposes of physiological modeling, Hodgkin and Huxley's model of action potential, model of the whole neuron, Huxley model of isotonic muscle contraction, modeling of EMG, modeling of ECG, electrical analog of blood vessels, model of systematic blood flow, model of coronary circulation, transfer of solutes between physiological compartments by fluid flow, counter current model of urine formation, model of Henle's loop, linearized models: immune response, pulmonary mechanics and thermoregulation.	14

COURSE OUTCOMES

At the end of the course, students should be able to:

1. Demonstrate the regulation and control mechanism of various physiological process / biological systems.
2. Simulates _____ and _____ analyze physiological systems in time and frequency domain and to understand the concept of system stability.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Biomedical Engineering

(Applicable from the academic session 2018-2019)

3. Interpret the biological significance of linear and nonlinear control systems.
4. Apply principles of mathematical modeling in understanding the various biological systems.
5. Formulate methods and techniques for analysis and synthesis of dynamic models.
6. Create mathematical and computational models in the analysis of physiological process/biological systems as well as implement and evaluate it to meet desired needs in healthcare.

Text/Reference Books:

1. Ogata Katsuhika, "Modern control engineering", 2nd ed, Prentice Hall of India.
2. Ibrell and Guyton, "Regulation and control in physiological system",
3. Milsum John H., "Biological control systems analysis", Tata McGraw-Hill.
4. Milhorn T.H. Saunder, "Application of control theory to physiological systems",
5. Suresh.R. Devasahayam, "Signals and Systems in Biomedical Engineering", Kluwer Academic/Plenum Publishers.
6. V.Z. Marmarelis, "Advanced methods of physiological modeling", Plenum Press.
7. J. Candy, "Signal Processing: The Model Based approach", Mc.Graw Hill.
8. Enderle, Blanchard & Bronzino, "Introduction to Biomedical Engineering", Academic press.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Biomedical Engineering
(Applicable from the academic session 2018-2019)

Name of the Course	BIOMEDICAL MEMS & NANOTECHNOLOGY
Course Code: OE-BME702	Semester: Seventh
L-T-P-C: 3-0-0-3	Contact: 3 hrs/week
Objectives:	
1	To understand the working principle of MEMS and Microsystems.
2	To learn various MEMS fabrication techniques and application of BioMEMS in healthcare.
3	To study about nanotechnology and its application in medical field.
4	To know about electro kinetic phenomena, micro sensors, micro actuators and drug delivery systems.
Pre-Requisite: Human Physiology, Biophysics & Biochemistry, Basic Knowledge of Mathematics, Biology, Electronics, Mechanics and Basics of Sensors	

M#	Content	Hrs
1	MEMS & Microsystems: Introduction to MEMS and microelectronics, MOEMS, microsystems and miniaturization, principles of microsystems, micro-sensors, micro-actuation, micro-accelerators, application of microsystems in healthcare industry.	7
2	MEMS Materials & Fabrication: Materials for MEMS, active substrate materials, silicon and its compounds, silicon piezoresistors, gallium arsenide, quartz, polymers, photolithography, thin film deposition, doping, etching, bulk micromachining, wafer bonding, LIGA.	9
3	BioMEMS: Introduction to BioMEMS, BioMEMS for clinical monitoring, lab on a chip, DNA Sensors, E-Nose, E-Tongue, microsystem approaches to PCR, MEMS based implantable drug delivery system, emerging BioMEMS technology.	8
4	Nanoscience & Nanotechnology: Nanoscience and nanotechnology in biology and medicine- an overview, nanomaterials, quantum well, wire, dot, carbon nanotubes, carbon nanotube biosensors.	6
5	Nanomedicine: Carbon nanotubes for monitoring antibody-antigen reaction, drug delivery and monitoring drug interaction using nanotubes and nanowires, quantum dots for drug discovery and imaging, quantum dots and gold nanoparticles for cancer treatment, nanoparticle mediated gene therapy, growth of neurons on nanomaterials, nanomaterials for brain protection and repair, DNA biochips, nanorobotics for surgery	10

COURSE OUTCOMES

At the end of the course, students should be able to:

1. Demonstrate the working principles of MEMS and Microsystem and their application in medical field.
2. Explain and evaluate various MEMS fabrication techniques.
3. Design and develop miniaturized biomedical sensors and BioMEMS for practical applications.
4. Demonstrate a detailed understanding of the fundamental principles of nanotechnology and their application to biomedical engineering.
5. Analyse nanosensors and nanodevices for diagnostics and therapeutic purposes.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Biomedical Engineering

(Applicable from the academic session 2018-2019)

6. Apply knowledge of nanotechnology to identify how they can be exploited for new applications.

Text/Reference Books:

1. Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata McGraw Hill Publishing Company, New Delhi, 2002. (Unit I, II, III & IV).
2. Wanjun Wang, Stephen A. Soper, "BioMEMS: Technologies and Applications", CRC Press, New York, 2007 (Unit V)
3. Mark J. Schulz, Vesselin N. Shanov, Yeoheung Yun, "Nanomedicine Design of Particles, Sensors, Motors, Implants", Arctech House, 2009.
4. Neelina H. Malsch, "Biomedical Nanotechnology", CRC Press, 2005.
5. Chang Liu, "Foundations of MEMS", Pearson Education International, New Jersey, USA, 2006.
6. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press, First Edition 2002
7. Abraham P. Lee and James L. Lee, "BioMEMS and Biomedical Nanotechnology", Volume I, Springer, First Edition 2006.
8. Steven S. Saliterman, "Fundamentals of BioMEMS and Medical Microdevices", International Society for Optical Engineering, First Edition 2006

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Biomedical Engineering
(Applicable from the academic session 2018-2019)

Name of the Course	MEDICAL ROBOTICS & AUTOMATION
Course Code: OE-BME703	Semester: Seventh
L-T-P-C: 3-0-0-3	Contact: 3 hrs/week
Objectives:	
1	To introduce fundamental concepts in robotics, robot structure and workspace.
2	To expose to a broad range of topics in robotics with emphasis on basics of actuators, grippers, manipulators, kinematics and sensors system.
3	To provide the basic knowledge on design, analysis, control and working principle of robotics in medical field.
Pre-Requisite: Basic Knowledge of Electronics, Sensors, Mechanics	

M#	Content	Hrs
1	Introduction of Robotics: Introduction to robots, robot subsystems and classification, degrees of freedom, configurations and concept of workspace, automation, mechanisms and movements, dynamic stabilization, applications of robotics in medicine.	8
2	Actuators & Grippers: Pneumatic and hydraulic actuators, stepper motor control circuits, end effectors, various types of grippers, design consideration in vacuum and other methods of gripping, PD and PID feedback actuator models.	8
3	Manipulators & Basic Kinematics: Construction of manipulators, manipulator dynamic and force control, electronic and pneumatic manipulator, forward kinematic problems, inverse kinematic problems, solutions of inverse kinematic problems.	8
4	Power Sources & Sensors: Sensors and controllers, internal and external sensors, position, velocity and acceleration sensors, proximity sensors, force sensors, laser range finder, variable speed arrangements, path determination, machinery vision, ranging, laser, acoustic, magnetic, fiberoptic and tactile sensor.	9
5	Robotics in Medicine: Biologically inspired robots, Da Vinci surgical system, image-guided surgical robotic systems, robotic tele-surgical system, bionic arm, clinical and surgical-cardiology, gynaecology, orthopaedics and neurology.	7

COURSE OUTCOMES

At the end of the course, students should be able to:

1. Demonstrate the state of the art medical robots and their operational workspace characteristics.
2. Select and identify suitable automation hardware for given application.
3. Analyze and design the motion for articulated systems.
4. Identify and describe different types of medical robots and their potential applications.
5. Simulate the basic concepts in kinematics, dynamics and control relevant to medical robotics.
6. Design and implement robotic assistance for both minimally invasive surgery and image-guided interventions.

Text/Reference Books:

1. Nagrath and Mittal, "Robotics and Control", Tata McGraw-Hill, First edition, 2003.
2. Spong and Vidyasagar, "Robot Dynamics and Control", John Wiley and Sons, First edition, 2008.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Biomedical Engineering

(Applicable from the academic session 2018-2019)

3. Fu.K.S,Gonzalez,R.C.,Lee,C.S.G,“Robotics,control”,sensing,VisionandIntelligence,T
ataMcGrawHillInternational, Firstedition, 2008.
4. HowieChoset,KevinLynch,SethHutchinson, GeorgeKantor,WolframBurgard,Lydia
Kavrakiand Sebastian
Thurn,“PrinciplesofRobotMotion:Theory,Algorithms,andImplementations”,PrenticeH
allof India, Firstedition, 2005.
5. PhilippeCoiffet,MichelChirouze,“AnIntroductiontoRobotTechnology”,TataMcGraw-
Hill,FirstEdition, 1983.
6. JacobRosen,BlakeHannaford&RichardMSatava,“SurgicalRobotics:SystemApplication
s& Visions”,Springer2011.
7. [http://www.lapsurg.com.br/arquivos/books/medical_robotics12402am020100000000.
pdf](http://www.lapsurg.com.br/arquivos/books/medical_robotics12402am020100000000.pdf)
8. BarbaraWebbandThomasRConsi,“BioRobotics:Methods&Applications”,BarbaraWeb
bandThomasRConsi, AAAIPress/MITPress, FirstEdition, 2001.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Biomedical Engineering
(Applicable from the academic session 2018-2019)

Name of the Course	INDIAN CONSTITUTION
Course Code: MC-HU701	Semester: Seventh
L-T-P-C: 2-0-0-0	Contact: 2 hrs/week
Objectives:	
1	To have basic knowledge about Indian Constitution.
2	To understand the structure and functioning of union, state and local self-government.
3	To understand the structure, jurisdiction and function of Indian judiciary.
Pre-Requisite: NIL	

M#	Content	Hrs
1	Introduction to Constitution of India: Sources of Constitutional history, Preamble and its Salient Features, Citizenship, Fundamental Rights and Duties, Directive Principles of State Policy.	3
2	Union Government & its Administration: Structure of the Indian Union- Federalism, Centre-State relationship, President - Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.	6
3	State Government & its Administration: Governor - Role and Position, CM and Council of ministers, State Secretariat - Organization, Structure and Functions.	3
4	The Judiciary: The Supreme Court - Organization, Procedure, Jurisdiction and Power, Chief Justice and other Judges High Court/s - Organization, Procedure, Jurisdiction and Power Chief Justice and other Judges, Subordinate Courts - Structure, Jurisdiction and Procedure, Lok Adalats, PIL - Scope, Principle and Features	8
5	Local Administration & Election Commission: Municipalities, Municipal Corporations, Town Area, Notified Area, Mayor - Role and Function, Zilla Parishad, Aanchal Parishad and Gram Panchayats, Powers, Functions and Key Functionaries, Chief Election Commissioner and Election Commissioners - Role and Functioning, State Election Commission: Role and Functioning..	6

COURSE OUTCOMES

At the end of the course, students should be able to:

1. Describe the features of Indian Constitution.
2. Describe the power and functioning of union, state and local self-government.
3. Workings of the various legislative, executive and judicial bodies in the country.
4. Appreciate the democratic workings at the grassroots level.
5. Illustrate the jurisdiction and procedures of Indian Courts.
6. Identify authority to redress a problem in the profession and in the society.

Text/Reference Books:

1. 'Indian Polity' by Laxmikanth, McGraw Hill Publications, 5th Edition.
2. 'Indian Administration' by Subhash Kashyap
3. 'Indian Administration' by Avasti and Avasti
4. Introduction to the Constitution of India, D Basu, Lexis Publications of India, 21st Edition.

Maulana Abul Kalam Azad University of Technology, West Bengal
 (Formerly West Bengal University of Technology)
Syllabus for B. Tech in Biomedical Engineering
 (Applicable from the academic session 2018-2019)

Name of the Course		MEDICAL IMAGE PROCESSING LABORATORY
Course Code: PC-BME791		Semester: Seventh
L-T-P-C: 0-0-2-1		Contact: 2 hrs/week
Objectives:		
1	To learn fundamental image processing techniques and characteristics of different types of medical images.	
2	To understand the basic medical image enhancement, transforms, segmentation, compression, representation techniques and algorithms for quality improvement of an image.	
3	To practice the basic image processing techniques and application of different classical image processing techniques for different types of medical images.	

LIST OF EXPERIMENTS:

1. Image characterization and digital image fundamentals
2. LP, HP, Mean and Median filtering of medical images
3. Image transformation technique of medical images
4. Image enhancement by histogram
5. Image smoothing technique of medical images
6. Image sharpening technique of medical images
7. Point, line and edge detection algorithms
8. Image segmentation technique of medical images
9. Image compression technique of medical images
10. Morphological image processing
11. Reconstruction of CT images
12. Fourier reconstruction of MRI images
13. A mini project based on medical image processing

COURSE OUTCOMES

At the end of the course, students should be able to:

1. Employ image processing and analysis techniques appropriate to medical imaging.
2. Perform different operations to improve the quality of medical images.
3. Design and implement algorithm(s) for a medical image processing application.
4. Apply image processing technique to solve real health care problems.

Maulana Abul Kalam Azad University of Technology, West Bengal
 (Formerly West Bengal University of Technology)
Syllabus for B. Tech in Biomedical Engineering
 (Applicable from the academic session 2018-2019)

Name of the Course	INDUSTRIAL / HOSPITAL TRAINING EVALUATION
Course Code: PROJ-BME792	Semester: Seventh
L-T-P-C: 0-0-2-1	Contact: 2 hrs/week
Objectives:	
1	To visualize the real working environment and get acquainted with the organization structure, business operations and administrative functions.
2	To observe medical professionals at work and the roles of allied health professionals.
3	To provide hands-on experience at site where biomedical equipment are manufactured or utilized (hospitals).
4	To use the knowledge of one's own role and those of other professions to address the healthcare needs of populations and patients served.

GUIDELINES:

- Complete training in any leading multi-speciality hospital /medical industry for duration of 2-4 weeks.
- Prepare an extensive report as per the standard format and submit to the concerned course in-charge during the session.
- Evaluation should be based on the presentation, viva-voce and final report.

COURSE OUTCOMES

At the end of the course, students should be able to:

1. Communicate with other health professionals and practice professional ethics and legal issues in workplace.
2. Recognize the importance of inter-professional collaboration in healthcare.
3. Analyze real-time problems and advocate an appropriate problem-solving methodology.
4. Propose a patient-centered inter-professional health improvement plan based upon the patient's perceived needs.

Maulana Abul Kalam Azad University of Technology, West Bengal
 (Formerly West Bengal University of Technology)
Syllabus for B. Tech in Biomedical Engineering
 (Applicable from the academic session 2018-2019)

Name of the Course	PROJECT-I
Course Code: PROJ-BME793	Semester: Seventh
L-T-P-C: 0-0-12-6	Contact: 12 hrs/week
Objectives:	
1	To enable the students to come up with their own innovative ideas and realize it.
2	To develop skills to formulate a technical project.
3	To gain experience in organization and implementation of a small project and thus acquire the necessary confidence to carry out main project.
4	To provide guidelines to prepare technical report of the project.

GUIDELINES:

- Project should be carried out by a group of 3 or 4 and not more than 4 in a group.
- Project may be a hardware or combination of hardware and software.
- PCB soldering and testing.
- Documentation in the form of project report is to be submitted at the end of the semester.
- Evaluation should be based on the demonstration, viva-voce and final report.

COURSE OUTCOMES

At the end of the course, students should be able to:

1. Express the technical ideas, strategies and methodologies.
1. Convert ideas of interest into a conceptual model.
2. Work in a group in a collaborative and productive manner.
3. Prepare technical report and present theoretical demonstrations.

Special Remarks:

The above mentioned outcomes are not limited. Institute may redefine course outcomes based on their Program Educational Objectives (PEOs).